

NEBRASKA MATHEMATICS STANDARDS

Grades K-12

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Nebraska Mathematics Standards

Grades K-1

1.1 NUMERATION/NUMBER SENSE

1.1.1 **By the end of first grade, students will recognize, write, and orally express the sequential order of the number system.**

Example indicators:

- Recognize and write numerals from 0-100.
- Count forward by 1s, 2s, 5s and 10s up to 100.
- Count backward from 10 to 0 by 1s.
- Identify ordinal positions of first, second, third, through tenth.

1.1.2 **By the end of first grade, students will demonstrate ways of representing numbers and compare relations among numbers.**

Example indicators:

- Count objects to demonstrate one-to-one correspondence.
- Use comparison vocabulary (bigger, smaller, more, less, equal, higher, and lower).
- Identify and represent wholes into equal parts for the fractions of one-half and one-fourth.
- Connect number words and numerals to the quantities they represent.
- Demonstrate place value in the base-ten number system using models.

1.1.3 **By the end of first grade, students will identify numbers and applications in everyday situations.**

Example indicators:

- Identify how numbers are used in counting situations (setting the table and passing out candy treats).
- Identify how numbers are used for identification (room numbers and phone numbers).
- Recognize and demonstrate the value of a collection of pennies, nickels, dimes, and quarters whose total value is 100 cents or less.

1.1.4 **By the end of first grade, students will demonstrate the value of numbers (0-20) using concrete objects.**

1.2 COMPUTATION/ESTIMATION

1.2.1 **By the end of first grade, students will demonstrate the concepts of addition and subtraction up to 10.**

Example indicators:

- Demonstrate the value of basic facts using concrete objects.
- Recognize the symbols + and - as representing the operations of addition and subtraction.
- Recognize the symbol = represents equal quantities.
- Solve problems involving one-step solutions related to children's experiences.

- Demonstrate strategies for whole number computation.
- Compute efficiently and accurately basic number facts for addition and subtraction.

1.2.2 By the end of first grade, students will justify estimations to mathematical problems.

Example indicator:

- Make estimations and comparisons to actual results.

1.3 MEASUREMENT

1.3.1 By the end of first grade, students will measure two or more items or sets using nonstandard units of measure and compare attributes.

Example indicators:

- Compare attributes of items (length-shorter/longer, height-taller/shorter, weight-heavier/lighter, and temperature-hotter/colder).
- Measure items using nonstandard units (human foot, hand span, new pencil, toothpick, block, and paper clip).

1.3.2 By the end of first grade, students will identify tools of measurement and their appropriate use (clocks, calendar, ruler, balance scale, and thermometer).

1.3.3 By the end of first grade, students will tell time to the half-hour using an analog and digital clock.

1.3.4 By the end of first grade, students will identify the different units of measurement used in their environment (cents, dollars, pounds, gallons, liters, meters, miles, minutes, and hours).

1.3.5 By the end of first grade, students will identify past, present, and future as orientations in time.

1.4 GEOMETRY/SPATIAL CONCEPTS

1.4.1 By the end of first grade, students will compare relative position (left/right, above/below, over/under, up/down, and near/far).

1.4.2 By the end of first grade, students will identify, describe, and create circles, squares, triangles, and rectangles.

Example indicators:

- Construct congruent shapes and designs using manipulatives.
- Identify and describe common geometric shapes in their environment.

1.5 DATA ANALYSIS, PROBABILITY, AND STATISTICAL CONCEPTS

1.5.1 By the end of first grade, students will collect information about objects and events in their environment (favorite candy bar, number of siblings, and number of pets).

1.5.2 By the end of first grade, students will organize and display collected information using objects and pictures.

1.5.3 By the end of first grade, students will compare and interpret information from displayed data (more, less, and fewer).

1.5.4 By the end of first grade, students will describe the process used in data collection and analysis.

1.6 ALGEBRAIC CONCEPTS

1.6.1 By the end of first grade, students will identify, describe, extend, and create patterns (objects, sounds, movements, shapes, numbers, and colors).

1.6.2 By the end of first grade, students will sort and classify objects according to one or more attributes (size, shape, color, and thickness).

1.6.3 By the end of first grade, students will identify and describe patterns in their environment.

Grades 2-4

4.1 NUMERATION/NUMBER SENSE

4.1.1 By the end of fourth grade, students will demonstrate place value of whole numbers through the millions and decimals to the hundredth place.

Example indicators:

- Read and write numerals (in digits and words) through the one millions place and decimals to the hundredth place.
- Order and compare whole numbers through the one millions place and decimals to the hundredths place using the symbols $<$, $>$, and $=$.
- Round whole numbers to the nearest named place, such as rounding 1,234 to the nearest hundred would be 1,200.

4.1.2 By the end of fourth grade, students will write and illustrate equivalences of whole numbers in expanded form, decimals, and fractions.

Example indicators:

- Write numbers in expanded form, such as $432 = 400 + 30 + 2$.
- Represent equivalent fractions with denominators of 2, 4, 5, 8 and 10 ($1/2 = 2/4$) using concrete objects.
- Write equivalent decimals ($.4 = .40$).
- Write decimals as fractions using denominators of 10 and 100 ($.68 = 68/100$).

4.1.3 By the end of fourth grade, students will describe and apply relationships between whole numbers, decimals, and fractions by order, comparison, and operation.

Example indicators:

- Order and compare whole numbers, common fractions, and decimals using the symbols $<$, $>$, and $=$.
- Illustrate mathematical concepts by using objects and drawing pictures or diagrams (subtraction as the opposite of addition and multiplication as repeated addition).
- Solve and check a mathematical problem by using the related facts.

4.1.4 By the end of fourth grade, students will identify examples of positive and negative numbers and zero.

Example indicator:

- Demonstrate simple concepts of positive and negative numbers (a thermometer for temperature or distances to the right or left of zero on a number line).

4.1.5 By the end of fourth grade, students will make change and count out in amounts up to \$20.00.

Example indicators:

- Count back change from purchase price to amount given using fewest coins possible.
- Calculate change through subtraction and choose correct bills and coins to make this amount.

4.2 COMPUTATION/ESTIMATION

4.2.1 By the end of fourth grade, students will estimate, add, subtract, multiply, and divide whole numbers without and with calculators and solve word problems.

Example indicators:

- Demonstrate with accuracy and reasonable speed the basic facts of addition (1-20), subtraction (1-20), multiplication (1-144), and division (1-144).
- Add and subtract accurately five-digit numbers including columns of numbers.
- Multiply up to a three-digit number by a two-digit number.
- Divide up to a three-digit number by a one-digit divisor.
- Choose correct operation and solve word problems.

4.2.2 By the end of fourth grade, students will estimate, add, and subtract decimals without and with calculators and solve word problems.

Example indicator:

- Add and subtract decimals to the hundredths place.

4.2.3 By the end of fourth grade, students will estimate, add, and subtract fractions with like denominators without calculators and solve word problems.

Example indicator:

- Solve problems involving fractions of halves, fourths, and eighths using the operations of addition and subtraction.

4.3 MEASUREMENT

4.3.1 By the end of fourth grade, students will estimate, measure, and solve word problems using metric units for linear measure, area, mass/weight, capacity, and temperature.

Example indicators:

- Use the appropriate units of measurement.
- Estimate and accurately measure length to the nearest meter or centimeter and calculate area.
- Estimate and accurately measure mass/weight to the nearest gram.

- Estimate and accurately measure capacity to the nearest milliliter.
- Measure and read temperature accurately to the nearest degree using Celsius thermometer.

4.3.2 By the end of fourth grade, students will estimate, measure, and solve word problems using standard units for linear measure, area, mass/weight, capacity, and temperature.

Example indicators:

- Use the appropriate units of measurement.
- Estimate and accurately measure length to the nearest yard, foot, inch, and quarter inch and calculate area.
- Estimate and accurately measure mass/weight to the nearest ounce and pound.
- Estimate and accurately measure capacity to the nearest fluid ounce.
- Measure and read temperature accurately to the nearest degree using Fahrenheit thermometer.

4.3.3 By the end of fourth grade, students will tell and write correct time to the minute using an analog clock.

Example indicators:

- Set an analog clock to a given time.
- State time in different ways (8:35, 35 minutes after 8:00, or 25 minutes until 9:00).
- Identify time of day (am, pm, noon, and midnight).

4.3.4 By the end of fourth grade, students will measure and determine the perimeter of a many-sided figure without a formula using standard and metric units of measure.

4.4 GEOMETRY/SPATIAL CONCEPTS

4.4.1 By the end of fourth grade, students will identify, describe, and create two- and three-dimensional geometric shapes.

4.4.2 By the end of fourth grade, students will identify and draw points, lines, line segments, rays, and angles.

4.4.3 By the end of fourth grade, students will identify, analyze, and compare two-dimensional geometric figures using congruence, symmetry, similarity, and simple transformations.

4.5 DATA ANALYSIS, PROBABILITY, AND STATISTICAL CONCEPTS

4.5.1 By the end of fourth grade, students will collect, organize, record, and interpret data and describe the findings.

Example indicators:

- Collect, organize, and interpret data in line plots, tables, charts, and graphs (pie graphs, bar graphs, and pictographs).
- Draw valid conclusions from displayed data.
- Investigate and record patterns in a simple probability situation in an organized way.

4.6 ALGEBRAIC CONCEPTS

4.6.1 By the end of fourth grade, students will use and interpret variables and mathematical symbols to write and solve one-step equations.

Example indicators:

- Use letters, boxes, or other symbols to stand for any number, measured quantity, or object in simple situations to demonstrate the beginning concept of a variable and writing formulas.
- Identify and use various indicators of multiplication (parentheses, \times , $*$) and division, ($/$, \div).

4.6.2 By the end of fourth grade, students will identify, describe, and extend arithmetic patterns, using concrete materials and tables.

Example indicator:

- Use Input/Output or function box to identify and extend patterns.

Grades 5-8

8.1 NUMERATION/NUMBER SENSE

8.1.1 By the end of eighth grade, students will recognize natural numbers, whole numbers, integers, and rational numbers.

8.1.2 By the end of eighth grade, students will determine equivalences among fractions, decimals, and percents.

Example indicators:

- Find the equivalencies among fractions, decimals, and percents.
- Solve problems with appropriate equivalencies.

8.1.3 By the end of eighth grade, students will write and use numbers in expanded exponential form and scientific notation.

Example indicators:

- Write numbers in expanded form using exponential notation.
- Express small and large numbers using scientific notation.

8.1.4 By the end of eighth grade, students will identify and display numbers including prime and composite, factors and multiples, divisibility, powers, and properties.

Example indicator:

- Properties of numbers may include, but not be limited to, order of operations, commutative, associative, distributive, identity, and inverse.

8.2 COMPUTATION/ESTIMATION

8.2.1 By the end of eighth grade, students will add, subtract, multiply, and divide decimals and proper, improper, and mixed fractions with uncommon and common denominators with and without the use of technology.

8.2.2 By the end of eighth grade, students will identify the appropriate operation and do the correct calculations when solving word problems.

8.2.3 By the end of eighth grade, students will solve problems involving whole numbers, integers, and rational numbers (fractions, decimals, ratios, proportions, and percents) with and without the use of technology.

Example indicators:

- Use proportions to solve scale-model problems with fractions and decimals.
- Problems should be of increasing level of difficulty and involve real-life situations.

8.2.4 By the end of eighth grade, students will apply the order of operations to solve problems with and without the use of technology.

Example indicator:

- Evaluate all types of numerical expressions, including grouping symbols and exponents.

8.2.5 By the end of eighth grade, students will apply strategies of estimation when solving problems with and without the use of technology.

Example indicators:

- Properly round to an appropriate place value if context permits.
- Perform estimation prior to calculation.
- Without a calculator, estimate square roots of whole numbers up to one hundred to the nearest whole number.
- Use compatible numbers to perform mental math.
- Use estimation to check reasonableness of an answer.

8.3 MEASUREMENT

8.3.1 By the end of eighth grade, students will select measurement tools and measure quantities for temperature, time, money, distance, angles, area, perimeter, volume, capacity, and weight/mass in standard and metric units at the designated level of precision.

8.3.2 By the end of eighth grade, students will convert units within measurement systems using standard and metric, given conversion factors.

Example indicators:

- Convert between various units of area and various units of volume (square foot to square yards and cubic decimeters to liters, etc.).
- Check solutions to problems using unit analysis (feet/second to miles/hour).

8.4 GEOMETRY/SPATIAL CONCEPTS

8.4.1 By the end of eighth grade, students will identify, describe, compare, and classify two- and three dimensional geometric figures - plane figures like polygons and circles; solid figures like prisms, pyramids, cones, spheres, and cylinders; lines, line segments, rays, angles, parallel and perpendicular lines.

8.4.2 By the end of eighth grade, students will use geometric properties, the Pythagorean theorem, and the relationships of congruence, similarity, and symmetry.

8.4.3 By the end of eighth grade, students will use formulas to solve problems involving perimeter and area of a square, rectangle, parallelogram, trapezoid and triangle, as well as the area and circumference of circles.

8.4.4 By the end of eighth grade, students will solve problems given formulas for volume and surface area of rectangular prisms, cylinders, and cones.

8.4.5 By the end of eighth grade, students will apply transformations to two- and three-dimensional geometric figures.

Example indicator:

- Draw geometric figures using translations or slides, rotations or turns, reflections or flips, and scale.

8.4.6 By the end of eighth grade, students will use geometric terms and representations to describe the physical world.

8.5 DATA ANALYSIS, PROBABILITY, AND STATISTICAL CONCEPTS

8.5.1 By the end of eighth grade, students will collect, construct, and interpret data displays and compute mean, median, and mode.

Example indicator:

- Select appropriate representations of data when constructing data displays (graphs, tables, or charts).

8.5.2 By the end of eighth grade, students will read and interpret tables, charts, and graphs to make comparisons and predictions.

8.5.3 By the end of eighth grade, students will conduct experiments or simulations to demonstrate theoretical probability and relative frequency.

Example indicator:

- Compare the results of a simulation (relative frequency) to the theoretical probability (a three color spinner or a coin).

8.5.4 By the end of eighth grade, students will identify statistical methods and probability for making decisions.

Example indicators:

- Identify the use of appropriate sampling techniques.
- Identify the use of appropriate charts and graphs.
- Identify the use of measures of central tendency (mean, median, and mode) appropriately.

8.6 ALGEBRAIC CONCEPTS

8.6.1 By the end of eighth grade, students will demonstrate knowledge and use of the one- and two-dimensional coordinate systems.

Example indicators:

- Order numbers on a number line.
- Graph ordered pairs on a coordinate plane.
- Generate a table of ordered pairs to graph an equation in two variables.

8.6.2 By the end of eighth grade, students will apply algebraic concepts and operations to solve linear equations and word problems.

Example indicators:

- Solve multi-step equations with one variable.
- Use order of operations to evaluate algebraic expressions for given replacement values of the variables.
- Recognize and apply commutative, associative, distributive, inverse, and identity properties, and the properties of zero.

8.6.3 By the end of eighth grade, students will describe and represent relations, using tables, graphs, and rules.

Example indicator:

- Use variables to recognize and describe patterns.

Grades 9-12

12.1 NUMERATION/NUMBER SENSE

12.1.1 By the end of twelfth grade, students will describe and compare the relationships between subsets of real numbers.

Example indicators:

- Draw Venn diagrams including, but not limited to, natural, whole, integers, rational, irrational, and real numbers.
- Find intersection and union of two sets of numbers.
- Given a number, identify which subsets it belongs.
- Justify why a number does not belong to a specific set.

12.1.2 By the end of twelfth grade, students will express the equivalent forms of numbers using exponents, radicals, scientific notation, absolute values, fractions, decimals, and percents.

12.2 COMPUTATION/ESTIMATION

12.2.1 By the end of twelfth grade, students will solve theoretical and applied problems using numbers in equivalent forms, radicals, exponents, scientific notation, absolute values, fractions, decimals, and percents, ratios and proportions, order of operations, and properties of real numbers.

12.2.2 By the end of twelfth grade, students will justify solutions to mathematical problems.

Example indicator:

- Write an explanation based on the context of the problem stating why the solution is reasonable.

12.2.3 By the end of twelfth grade, students will perform estimations and computations of real numbers mentally, with paper and pencil, and with technology.

12.3 MEASUREMENT

12.3.1 By the end of twelfth grade, students will select and use measuring units, tools, and/or technology and explain the degree of accuracy and precision of measurements.

Example indicators:

- Explain the accuracy of the measurement.
- Explain the precision of the measurement tool.

12.3.2 By the end of twelfth grade, students will convert between metric and standard units of measurement, given conversion factors.

Example indicators:

- Change yards to meters.
- Change miles/hour to meters/second.

12.4 GEOMETRY/SPATIAL CONCEPT

12.4.1 By the end of twelfth grade, students will calculate perimeter and area of two-dimensional shapes and surface area and volume of three-dimensional shapes.

12.4.2 By the end of twelfth grade, students will create geometric models to describe the physical world.

Example indicators:

- Create perspective drawing.
- Create scale models.

12.4.3 By the end of twelfth grade, students will evaluate characteristics and properties of two- and three-dimensional geometric shapes.

Example indicators:

- Classify and compare attributes of two- and three- dimensional shapes.
- Classify shapes in terms of congruence and similarity and apply these relationships.
- Determine the effects of changing dimensions on perimeter, area, and volume.
- Investigate and deduce geometric properties using transformations such as translations, rotations, and reflections.

12.4.4 By the end of twelfth grade, students will apply coordinate geometry to locate and describe objects algebraically.

Example indicators:

- Graph a geometric shape and determine the slope of the sides.
- Identify the missing vertices of a polygon.

12.4.5 By the end of twelfth grade, students will apply right triangle trigonometry to find length and angle measures.

12.4.6 By the end of twelfth grade, students will apply geometric properties to solve problems.

Example indicator:

- Find missing angles and lengths of geometric shapes using geometric properties. (Properties may include but are not limited to similarity, parallel and line-transversal).

12.4.7 By the end of twelfth grade, students will apply deductive reasoning to arrive at a conclusion.

Example indicators:

- Justify steps when solving an algebraic equation using properties of real numbers.
- Use logic statements, paragraph proof, two-column proof, or algebraic proof to arrive at a conclusion.

12.5 DATA ANALYSIS, PROBABILITY, AND STATISTICAL CONCEPTS

12.5.1 By the end of twelfth grade, students will select a sampling technique to gather data, analyze the resulting data and make inferences.

Example indicators:

- Justify the chosen sampling techniques.
- Use technology to analyze data.

12.5.2 By the end of twelfth grade, students will write equations and make predictions from sets of data.

Example indicators:

- Display data in a scatter plot, describe its shape, and estimate how close the data comes to fitting an equation.
- Relate the slope of a regression line to the rate of change for the data set.
- Determine what the y-intercept or beginning value indicates about the data.
- Determine the validity of predictions made from regression equations.

12.5.3 By the end of twelfth grade, students will apply theoretical probability to represent problems and make decisions.

Example indicator:

- Explain the likelihood of the next event based on theoretical probabilities.

12.5.4 By the end of twelfth grade, students will evaluate how transformations on data affect the measures of central tendency and variability.

Example indicators:

- Describe how adding the same amount to each score changes the mean, median, mode, range, outliers, interquartile points, maximum, and minimum.
- Describe how dropping an outlier changes the other measures.

12.5.5 By the end of twelfth grade, students will interpret data represented by the normal distribution and formulate conclusions.

Example indicators:

- Sketch a normal or bell curve, label one and two standard deviations from the mean and fill in approximate percents associated with the deviations.
- Determine factors that will produce a curve that is not normal.
- Describe how sample size is related to a normal curve.
- Determine position or rank relative to others in a normally distributed group given the standard deviation and mean.

12.5.6 By the end of twelfth grade, students will calculate probabilities of independent events.

Example indicator:

- Calculate probabilities using the fundamental counting principle and permutations.

12.6 ALGEBRAIC CONCEPTS

12.6.1 By the end of twelfth grade, students will graph and interpret algebraic relations and inequalities.

Example indicators:

- Describe a graph by identifying intercepts, slopes, maximum, minimum, increasing, decreasing, parallel, and perpendicular.
- Use families of curves to describe the effect of changing coefficients of an equation.

12.6.2 By the end of twelfth grade, students will solve problems involving equations and inequalities.

Example indicator:

- Use appropriate methods to solve linear and quadratic equations.

12.6.3 By the end of twelfth grade, students will solve problems involving systems of two equations, and systems of two or more inequalities.

Example indicator:

- Solve systems by graphing, substitution, elimination or matrices.

12.6.4 By the end of twelfth grade, students will solve problems using patterns and functions.

Example indicators:

- Apply direct and indirect variations.
- Recognize the properties of families of functions.
- Recognize patterns of exponential growth and decay and their significance to real-life situations.
- Represent a problem in multiple formats (words, tables, graphs, and symbols).